Appendix A

Task 1

Bridge Coating Condition Assessment Guide – Rev. 2

Introduction

This guide provides visual samples of bridge coatings in different conditions for use in assigning appropriate condition ratings during normal, biennial bridge inspections. Utilizing a consistent methodology to assess and record the condition of coating provides critical data for decision making, both on a project and system level. To address this need, these guidelines have been developed to assist in the consistent evaluation of the coating in the field. These guidelines consist of specific guidance on rating coatings according the a 5-level condition state description scale. The overall approach of the guide is to rate a bridge coating condition for two portions of the bridge, the portion of the bridge at the beam ends and the mid portion of the bridge beam. The rating system corresponds to the historical MoDOT rating systems and according to contemporary SSPC scales. These condition state descriptions are coupled to the comprehensive visual guide that shows photographic illustration of coatings conditions in the field and their appropriate ratings, to enable consistency in the evaluations in the field.

The rating system includes a 5 rating scale, including condition ratings of Very Good, Good, Fair, Poor and Very Poor, as shown in Table 1. The Very Good rating is intended to capture the initial conditions following a recoating or overcoating (or a new coating system), when the coating is in like-new condition, or if no damage has developed in the coating system. The Good rating is intended to characterize those coating for which work is not needed, but rusting has initiated at a minor level. The Fair rating is intended to characterize a coating that is a good candidate for touch-up or selected overcoating, while the rusting is still at levels of <u>less than 1%</u>. The Poor rating is intended to characterize those coating for which overcoating is a viable option, and recoating may not be yet be required. Finally, the Very Poor rating is intended to characterize coatings in advanced stages of deterioration such that substantial repair/recoating is required, and <u>rusting is > 10%</u>. Although the suggested rating levels may correspond to possible repair strategies, it is not the intention of the guide that the inspector be assessing the possible repair strategies independently. Rather, the levels are intended to characterize the conditions of the coating at the bridge consistently such that possible repair strategies can be evaluated.

Table 1. Rating scale for coating condition evaluation.

Rating	Description
Very Good	Perfect, new condition. The coating is a new coating system with very little or no damage. This condition correlates to the SSPC rating 10, less than 0.01 % rust and SSPC-9 (Greater than 0.01 up to 0.03%).
Good	Some very minor corrosion: The coating system is in good condition, with little overall corrosion/rust corresponding to SSPC 8 (greater than 0.03 and up to 0.1 %).
Fair	The coating has observable damage corresponding to SSPC-7 (greater than 0.1 and up to 0.3 %) to SSPC-6 (Greater than 0.3% up to 1%).
Poor	The coating has widespread corrosion corresponding to SSPC-5(Greater 1% up to 3%) to SSPC-4 (Greater than 3% up to 10%).
Very Poor	The coating system is in advanced stages of deterioration, with greater than 10% rust corresponding to SSPC-3 or less.

Condition Assessment Methodology

In this rating scheme, the intent is to provide two separate scores for the bridge coating Ðone rating for the mid-span of the bridge, and on rating for the end-span. Guidance for using the rating scales are as follows:

1. The rating should be applied based on the coating condition for primary members.
2. The rating scale is appropriately applied when it represents the *overall condition* of the member sections being rated. A separate rating should be applied for the mid-span sections of the bridge and beam ends.
   - ÒBeam endsÓare those section of the primary member located < 12 ft. from the end of the beam, where the effects of the joint leakage are anticipated (See Figure 1).
   - ÒMid-spanÓare those sections of the bridge beam located between the Òbeam endsÓ(> 12 ft. from the beam ends.)

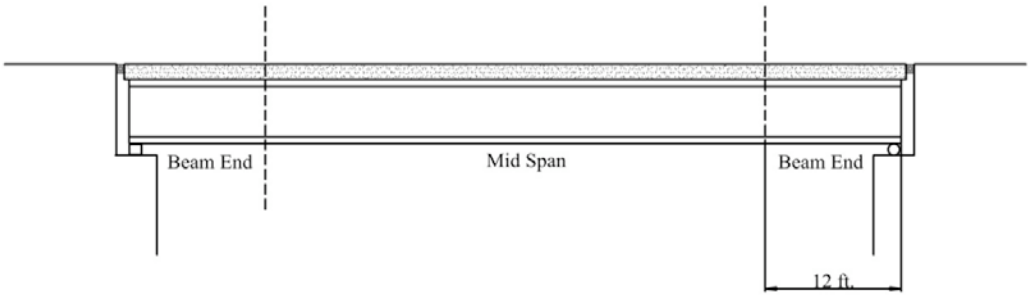


Figure 1. Schematic diagram showing mid-span and beam-ends.

3. Beam end conditions may be significantly different under certain condition due to variations in the expansion device performance and/or drainage characteristics of the bridge. In this case, *rate*

the beam-end with the lower rating. For example: A bridge runs east to west on a vertical slope such that the east side is higher than the west side, resulting in deck drainage at the west side. The beam-ends on the west side are in poor condition while the beam-end on the east side are in good condition. Rate the beam ends as poor. *Rationale: The condition assessment should capture the urgency of action, such that decision and predictions can be made based on the ratings. The fact that only the west-end is in poor condition affects the quantity of repair needed, but not the urgency of repair needed. As such, the beam-end in the worst condition needs to be rated.*

4. The ratings are improperly used if the attempt to describe a localized or nominally occurring instances of deterioration. For multi-beam structures, the rating should capture the overall condition of the members at mid-span and the beam-ends. *Rationale: Localized areas of deterioration are not uncommon for bridges, but typically do not reflect the urgency of a maintenance action, since the damage is localized. If such localized damage results in significant section loss, this is a structural condition that should be noted appropriately.*
5. The <u>extent of section loss</u> for a steel member is a <u>structural condition</u>, and should not influence the rating of the coating itself. <u>Section loss should be noted appropriately in the inspection results for the component.</u>
6. Peeling of paint: Paint peeling is an aesthetic condition that may not represent the effectiveness of a coating system for corrosion protection. Rating of the coating system is intended to represent the extent of corrosion (rust) that indicates the corrosion protection characteristics of the coating is compromised, and to what extent. If ratings based on peeling of paint are needed, they should be separated from the rusting evaluation (a separate TMS field, i.e. placed in the notes). Suggested ratings for peeling would by Good (<10%), Fair (10% - 30%) and poor(>30%).

<u>Discussion of Ratings Rules</u>

The rating rules are intended to provide suitable information to generally describe the overall condition of the coating in the mid-span and beam-ends for a given bridge. It is normal practice, and typical under the NBI, to provide ratings that describe the overall condition for the purposes of assessing the general condition of a component.

However, rating of the beam-ends as suggested here does adapt the philosophy that the worst beam-end condition should be reported. Based on the field survey, multi-span simply supported structures frequently have common condition characteristics at the beam ends. However, in some cases these beam ends may have very different conditions, if, for example, the drainage on the bridge is such that one beam end is exposed to very little run-off from the deck while another beam end is exposed to significant run-

off from the deck. In such a case, one beam-end may have a general condition of ÒgoodÓwhile the other has a general condition of Òpoor.Ó In such cases, inspector may assign a condition rating of ÒFair.Ó We feel that the appropriate rating for the condition is Òpoor,Óand as such have included the direction that the worst beam-end be reported, such that the rating suggests accurately the need for maintenance painting (overcoating) to improve corrosion protection at the bearing area, where section loss is a typical, though sometimes localized to the beam end, damage mode.

Visual Guide

To support the descriptive ratings of the condition ratings, this visual guide was prepared for use during inspections. The visual guide is based in general on the SSPC visual guides, but is intended to provide a visual scale that is suitable for highway bridges. The guide is intended to assist inspectors with choosing the appropriate rating for the mid-span and beam ends. The guide generally provides a combination of the elevation views, interior span views and close-up views for each rating to assist in the rating of the bridge. The photographs are intended to show the bridge from the inspector's typical perspective, commonly taken from a location near the bridge abutment. The guide consists generally of standardized photographs of different portions of a bridge structure that meet the subject rating guidance. For example, for the condition rating of Ògood,Óphotographs are shown that include an elevation of the facia girder and an elevation of the beam-end facia girder. Additional photos shows the interior characteristics, showing mid-span and beam ends for the interior sections. The intention of the guide is to provide context for the inspector evaluating a given bridge, to improve the reliability (i.e. consistency) of the condition ratings. Because the rating scales are inherently subjective and therefore subject to interpretation by the inspector, the photos should assist the inspectors in making more consistent evaluations.

Very Good Condition

Description: Perfect, new condition. The coating is a new coating system with very little or no damage. This condition correlates to the SSPC rating 10, less than 0.01 % rust and SSPC-9 (Greater than 0.01 up to 0.03%).

Very Good Condition – Facia Girder Mid-Span

Very Good Condition – Facia Girder Mid-Span

Very Good Condition – Facia Girder Mid-Span

Very Good Condition – Facia Girder Mid-Span

Very Good Condition – Interior Beam End-Span

Very Good Condition – Interior Beam End-Span

Very Good Condition – Interior Beam End-Span

Very Good Condition – Interior Beam Mid-Span

Very Good Condition – Interior Beam Mid-Span

Very Good Condition – Interior Beam Mid-Span

Very Good Condition – Interior Beam Mid-Span

Very Good Condition – Exterior Beam End-Span

Very Good Condition – Exterior Beam End-Span

Very Good Condition – Exterior Beam End-Span

Very Good Condition – Exterior Beam End-Span

Very Good Condition – Close-up

Very Good Condition – Close-up

Very Good Condition – Close-up

Very Good Condition – Close-up

Good Condition

Some very minor corrosion: The coating system is in good condition, with little overall corrosion/rust corresponding to SSPC 8 (greater than 0.03 and up to 0.1 %).

Good Condition – Facia Girder Mid-Span

Good Condition – Facia Girder Mid-Span

Good Condition – Facia Girder Mid-Span

Good Condition – Facia Girder Mid-Span

Good Condition – Facia Girder Mid-Span

Good Condition – Interior Beam End-Span

Good Condition – Interior Beam End-Span

Good Condition – Interior Beam End-Span

Good Condition – Interior Beam End-Span

Good Condition – Interior Beam Mid-Span

Good Condition – Interior Beam Mid-Span

Good Condition – Interior Beam Mid-Span

Good Condition – Interior Beam Mid-Span

Good Condition – Exterior Beam End-Span

Good Condition – Exterior Beam End-Span

Good Condition – Exterior Beam End-Span

Good Condition – Exterior Beam End-Span

Good Condition – Close-up

Good Condition – Close-up

Good Condition – Close-up

Fair Condition

The coating has observable damage corresponding to SSPC-7 (greater than 0.1 and up to 0.3 %) to SSPC-6 (Greater than 0.3% up to 1%).

Fair Condition – Facia Girder Mid-Span

Fair Condition – Facia Girder Mid-Span

Fair Condition – Facia Girder Mid-Span

Fair Condition – Facia Girder Mid-Span

Fair Condition – Facia Girder Mid-Span

Fair Condition – Interior Beam End-Span

Fair Condition – Interior Beam End-Span

Fair Condition – Interior Beam End-Span

Fair Condition – Interior Beam End-Span

Fair Condition – Interior Beam Mid-Span

Fair Condition – Interior Beam Mid-Span

Fair Condition – Interior Beam Mid-Span

Fair Condition – Interior Beam Mid-Span

Fair Condition – Exterior Beam End-Span

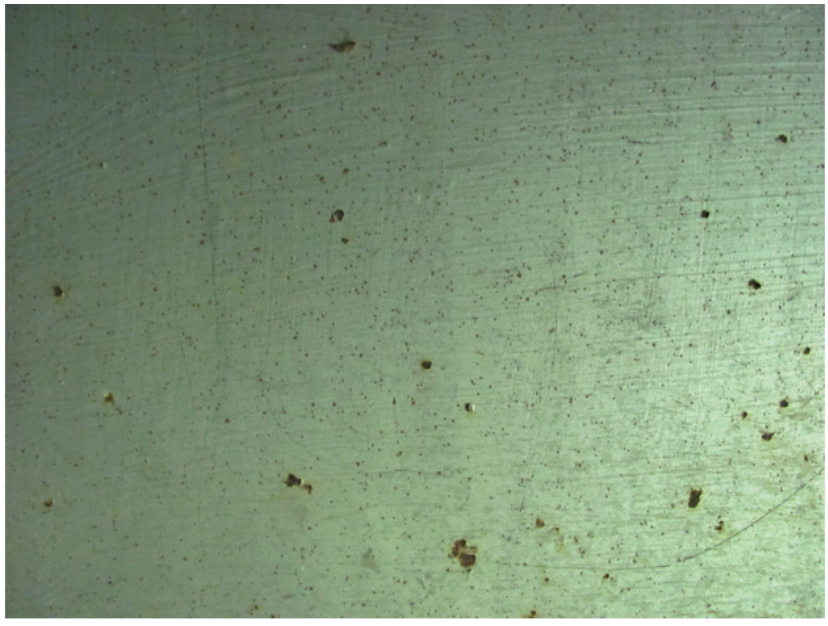
Fair Condition – Exterior Beam End-Span

Fair Condition – Exterior Beam End-Span

Fair Condition – Close-up

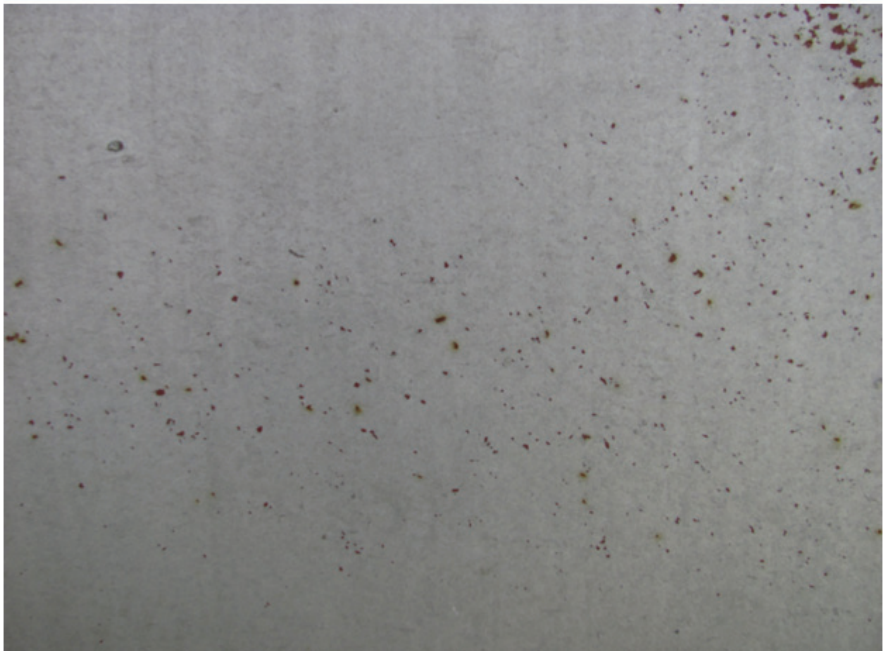
Fair Condition – Close-up

Fair Condition – Close-up



Fair Condition – Close-up

Fair Condition – Close-up



Fair Condition – Close-up

Poor Condition

The coating has widespread corrosion corresponding to SSPC-5(Greater 1% up to 3%) to SSPC-4 (Greater than 3% up to 10%).

Poor Condition – Facia Girder Mid-Span

Poor Condition – Facia Girder Mid-Span

Poor Condition – Facia Girder Mid-Span

Poor Condition – Facia Girder Mid-Span

Poor Condition – Interior Beam End-Span

Poor Condition – Interior Beam End-Span

Poor Condition – Interior Beam End-Span

Poor Condition – Interior Beam End-Span

Poor Condition – Interior Beam Mid-Span

Poor Condition – Interior Beam Mid-Span

Poor Condition – Interior Beam Mid-Span

Poor Condition – Interior Beam Mid-Span

Poor Condition – Interior Beam End-Span

Poor Condition – Exterior Beam End-Span

Poor Condition – Exterior Beam End-Span

Poor Condition – Exterior Beam End-Span

Poor Condition – Close-up

Poor Condition – Close-up

Poor Condition – Close-up

Poor Condition – Close-up

Very Poor Condition

The coating system is in advanced stages of deterioration, with greater than 10% rust corresponding to SSPC-3 or less.

Very Poor Condition – Facia Girder Mid-Span

Very Poor Condition – Facia Girder Mid-Span

Very Poor Condition – Facia Girder Mid-Span

Very Poor Condition – Facia Girder Mid-Span

Very Poor Condition – Facia Girder Mid-Span

Very Poor Condition – Interior Beam End-Span

Very Poor Condition – Interior Beam End-Span

Very Poor Condition – Interior Beam End-Span

Very Poor Condition – Interior Beam End-Span

Very Poor Condition – Interior Beam Mid-Span

Very Poor Condition – Interior Beam Mid-Span

Very Poor Condition – Interior Beam Mid-Span

Very Poor Condition – Interior Beam Mid-Span

Very Poor Condition – Interior Beam Mid-Span

Very Poor Condition – Interior Beam Mid-Span

Very Poor Condition – Exterior Beam End-Span

Very Poor Condition – Exterior Beam End-Span

Very Poor Condition – Exterior Beam End-Span

Very Poor Condition – Close-up

Very Poor Condition – Close-up

Very Poor Condition – Close-up

Very Poor Condition – Close-up

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Very Poor Condition – Close-up